Crisis in Flint: lead and Legionnaires' disease

The woes of the US city of Flint are being compounded by a surprising rise in Legionnaires' disease. Roxanne Nelson reports.

For more on the **class action suit against Governor, state, and officials** see http://i2.cdn.turner.com/cnn/2016/images/01/10/may.et.al.v.snyder.et.al.-.pacer.1.complaint.for.injunctive.and.declaratory.relief.pdf

For the **attorney general's statement** see http://abcnews.go.com/US/flint-water-crisis-investigation-exhaustive-independent-attorney-general/story?id=36502389

A modern American city seems an unlikely place to have contaminated drinking water, and yet, such is the situation in Flint. The seventh largest metropolitan area in the state of Michigan and with a population of nearly 100 000 people, the city has been ravaged by high crime, financial distress, and, most recently, an escalating public health crisis. The most pressing problem has been high levels of lead which have leached out from pipes and entered the city's water supply, but as they have grappled with that issue, more disturbing news has come their way.

From June, 2014, to November, 2015, there have been 87 cases of Legionnaires' disease and nine deaths reported in Genesee County, where Flint is located. This is a rather dramatic increase from the typical six to 13 annual cases that would be normally reported.

Thus far, federal and state health agencies have said that they are unable to make a direct link between the contaminated water supply and the spike in cases of Legionnaires. But that has not quelled speculation that the two crises might in fact be related.

Flint's water woes began in April, 2014, when the state-appointed emergency manager switched the city's water supply from Detroit's system, which comes from Lake Huron, to the Flint River, as a cost-saving measure. The water from Lake Huron is treated with anticorrosives, but none were added to the Flint system, as that would have boosted the cost by US$100 per day.

"To remove particulates and organic matter, the utility added coagulants of iron and chloride salts, which could corrode old iron pipes that deliver water to some homes", said Michele Swanson, a professor in the Department of Microbiology and Immunology at the University of Michigan Medical School, Ann Arbor, MI, USA. "To reduce pipe corrosion, utilities typically add phosphate, a measure that was not taken in Flint."

Iron that leaches from corroding pipes can react with chlorine disinfectants, inadvertently reducing their capacity to inactivate microbes, explained Swanson. "The balance of free iron and chloride likely varies widely in different parts of complex municipal water distribution systems, depending on water flow and on pipe composition and age."

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While this does not indicate causation, this type of situation could conceivably set up a favourable environment for some types of microbes to thrive. "Regions with excess iron may have favoured growth of some bacteria, including *Legionella pneumophila*", she said. "To culture this opportunistic pathogen in the laboratory, growth media must be supplemented with iron."

Like many towns in Michigan, Flint's economy was fuelled by the automobile industry, but when General Motors plants began closing in the 1980s the jobs left and so did many of the residents. Today the population is less than half of what it was in 1960, and it is estimated that about 40% of families live below the poverty line. Additionally, 57% of the population is black.

These demographics have led many of the residents to believe that if Flint was not a poor, black industrial town, state regulators would never have allowed this public health disaster to happen. State and county officials are now being accused of ignoring the crisis, even after it became obvious that something was amiss with their drinking water.

In brief, shortly after the switch in the water supply, residents begin to complain about the water's colour, taste, and odour, and to report health problems. 2 months later, coliform bacteria were detected in tap water, and by October, a General Motors plant in Flint stopped using municipal water because it was corroding auto parts.

But even though it was apparent that something was wrong with the water, and even after lead was detected in the drinking water in private homes, officials played down the issue and stated that the water was not an imminent "threat to public health".

By September, 2015, a group of physicians urged the city to stop using the Flint River for drinking water after high levels of lead had been found in the blood of children and, the following month, Flint was reconnected to Detroit's water system. A class action lawsuit was subsequently filed by five families against the governor, the city, and several other officials.

During the first week of January, the governor declared a state of emergency and shortly afterwards, the National Guard was mobilised to assist with the distribution of bottled water and water filters. President Obama has declared a federal state of emergency in Flint.

The Michigan state attorney general has now entered the picture to investigate the situation, and announced that "the tragedy of Flint

is a tragedy of immense proportions", and that "this investigation will be thorough, exhaustive, and independent".

The outbreak of *L pneumophila* has simply added another layer to the city's woes. Even though the cases began to escalate just 2 months after the city switched the water supply, conclusions cannot be drawn one way or another.

"A change in a water source might or might not have effect on the risk of Legionnaire's disease", said Kristen Nordlund, a spokesperson from the Centers for Disease Control and Prevention (CDC). "We don't have enough information, and might never have enough information, to make a connection between Legionnaires' disease and the Flint River water supply", she said.

The Michigan Department of Health and Human Services (MDHHS) has been trying to trace the source of the legionella cases.

According to the MDHHS, of the 87 total confirmed cases between June, 2014, and November, 2015, 31 (36%) used city water in their home. But 26 people (30%) had no known exposure to either a hospital using Flint water in the 2 weeks prior to illness, or Flint water at their residence. Officials evaluated other possible exposures but no known community exposures were identified.

"The legionella outbreak that was reported from June, 2014, to March, 2015, was found to have an association with a health-care facility, and that facility did undertake remediation", said Jennifer Eisner, a public information officer from the MDHHS.

During that period, 23 of 45 cases (51%) had exposure to McLaren Flint Medical Center, which is supplied by city water, during the 2 weeks prior to onset of symptoms.

"In order to make a definitive statement on environmental causation, you need a strain match", she said, in that a bacteria sample from a patient must be matched to one found in the water. "Our evidence is based on case investigations of patients which have pointed to certain associations but not cause. Our department, along with the CDC and experts in the field, remain proactive in addressing the potential for future cases."

But some are not waiting for a definitive answer. A $100 million lawsuit has just been filed against McLaren Flint Hospital and the State of Michigan by four residents who contracted the disease, saying they did nothing to combat the outbreak.

Roxanne Nelson

For the **MDHHS's full analysis** see http://mi.gov/documents/mdhhs/6-14_to_3-15_Legionellosis_Report_Full_Analysis_Results_511708_7.pdf

For more on the **$100 million lawsuit** see http://www.freep.com/story/news/local/michigan/flint-water-crisis/2016/02/02/fieger-flint-lawsuit-mclaren-water-crisis/79704852/

Infection disease surveillance update

Zika virus—global update

Between January, 2014, and Feb 5, 2016, 33 counties have reported autochthonous transmission of Zika virus. Brazil has reported the most number of cases, with the Brazilian national authorities estimating between 497 593 and 1 482 701 cases since the outbreak began in late 2014. Colombia has reported the second highest number of Zika virus cases; as of Jan 23, 2016, 20 297 cases had been reported since October, 2015. Seven countries have also had an increase in the incidence of microcephaly, Guillain-Barré syndrome, or both alongside the outbreaks of Zika virus, most notably Brazil. The other countries are Hawaii, French Polynesia, Colombia, El Salvador, Suriname, and Venezuela. This outbreak has led to the WHO declaring the clusters of microcephaly and other neurological disorders reported in Brazil and other countries to be a Public Health Emergency of International Concern. Brazil has reported 4783 cases of microcephaly between October, 2015, and Jan 30, 2016—between 2001 and 2014, the yearly average number of microcephaly reported in Brazil was 163. In Africa, the island of Cape Verde is the only country to report autochronous transmission; from October, 2015, 7081 cases have been recorded as of Jan 17, 2016.

Yellow fever in Angola

Since the end of 2015, the Angola Ministry of Health have reported 84 registered cases of yellow fever as of Feb 1, 2016. 25 of the registered cases died from their illness. The disease has spread to various neighbourhoods of the capital Luanda, and to Huila, Kwanza Sul, and Huambo. As part of the disease control activities, the government has started a vaccination campaign targeting 1·5 million children accompanied with awareness raising for preventative measures.

Dengue in Thailand

Thailand has reported 5129 cases of Dengue during January, 2016, spread across all the 76 provinces in Thailand, and in Bangkok. Nakornpathom, Samutsakorn, Rayong, Srisaket, and Bangkok have reported the most dengue cases. So far this year no fatalities have been reported. Thailand reported more 140 000 dengue cases in 2015.

Meningitis in Ghana

Health ministers in Ghana have reported an outbreak of pneumococcal meningitis, which began with suspected cases reported in December, 2015. As of Jan 29, 2015, 459 cases have been reported; 85 people have so far died from their illness. The region reporting the highest number of cases is the Brong-Ahafo Region, with 288 cases including 45 deaths.

Ruth Zwizwai

See Editorial page 265

For **WHO's Zika situation report** see http://apps.who.int/iris/bitstream/10665/204348/1/zikasitrep_5Feb2016_eng.pdf

For more on **yellow fever in Angola** see http://www.promedmail.org/post/3995342

For more on **dengue in Thailand** see http://outbreaknewstoday.com/dengue-in-thailand-tops-5000-cases-in-1st-month-locally-acquired-zika-case-reported-13797/

For more on **meningitis in Ghana** see http://outbreaknewstoday.com/ghana-meningitis-outbreak-now-account-for-85-deaths-who-responds-with-technical-assistance-81556/